Introduction to Criteria

- What exactly is meant by the term "Criteria"?
- What do the WQS regulations require for state adopted criteria?

-For what types of criteria has EPA developed recommendations?

Water Quality Criteria (40 CFR 131.3)

- Discussed in Sections 304(a) and 303(c) of the Act
- A concentration, level or narrative statement
- Represent a level of water quality that supports a particular use
- When criteria are met, water quality will protect the designated use

Water Quality Criteria
1 Word – 2 Meanings

- Scientifically defensible guidance developed and published by EPA per

  CWA § 304(a)

  - Basis for Federal promulgation when necessary

- Adopted part of State/Tribal WQS
  - Section 303(c)

Water Quality Criteria Requirements (40 CFR 131.11)

- States/Tribes Must adopt criteria that protect the designated use:
  - Based on a sound, scientific rationale
  - Sufficient parameters to protect the designated use
  - Must support the most sensitive use (for waters with multiple use designations)

Water Quality Criteria: Forms (40 CFR 131.11b)

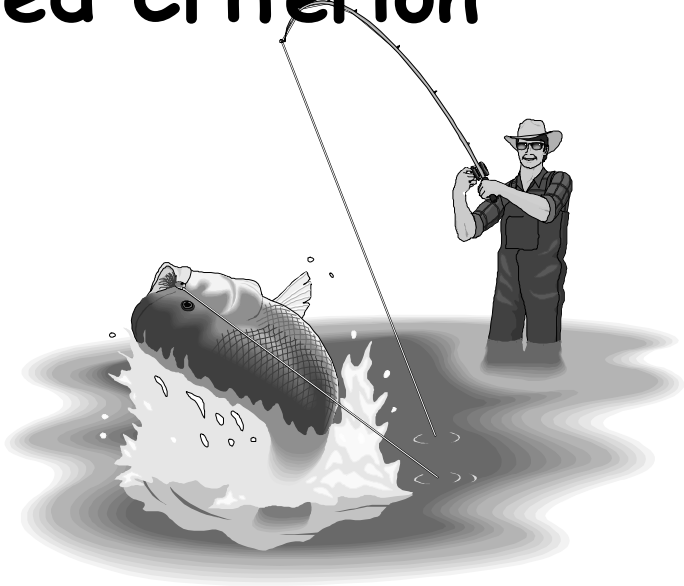
- States and Tribes should adopt numeric criteria based on:
  - 304(a) guidance
  - 304(a) guidance modified to reflect site specific conditions
  - Other scientifically defensible methods
- States/Tribes should adopt narrative criteria:
  - Where numeric criteria cannot be established
  - Or to supplement numeric criteria

Special Criteria Requirements for CWA 307(a) "Priority Pollutants"

- **1987 CWA Amendment - CWA Section 303(c)(2)(B)**
- **For 307(a) Pollutants Where EPA Has Published 304(a) Guidance – States Shall Adopt Numeric Criteria Where Discharge/Presence Can Reasonably be Expected to Interfere with Designated Uses**
- **States Must Identify How They Intend to Regulate Point Sources of Priority Pollutants if They Use Narrative Criteria**
- **EPA Promulgation**

NUMERIC CRITERION EXAMPLE

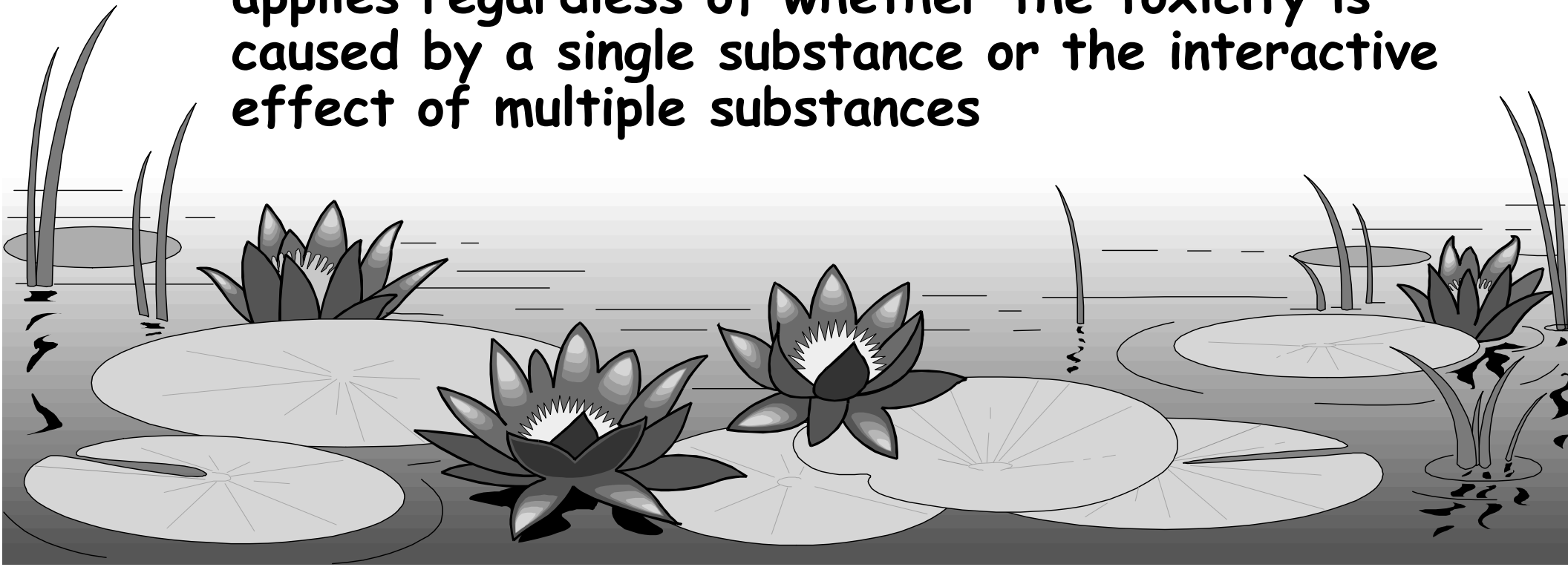
For the protection of Human Health from the Toxic Effects of Copper, the Concentration of Copper in Water Should not Exceed the Recommended Criterion Level of 1300 µg/L.



NARRATIVE CRITERION EXAMPLE

- **Toxicity**

All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances



TYPES OF WATER QUALITY CRITERIA

- Human Health Criteria
- Bacteriological Criteria
- Aquatic Life Criteria
- Sediment Quality Assessments
- Biological Criteria
- Nutrient Criteria
- Others

HUMAN HEALTH CRITERIA

- **Expressed as a Pollutant Concentration Based on:**
  - **Toxicological Assessment**
  - **Exposure Scenario**
- **Calculated for Ingestion of:**
  - **Aquatic Organisms Only**
  - **Water and Aquatic Organisms**

BACTERIOLOGICAL CRITERIA

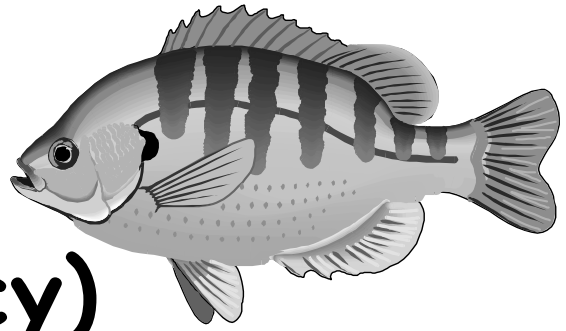
- **Expressed as a Bacterial Indicator Concentration Based on:**
  - **Epidemiological Studies**
  - **Selected Unacceptable Illness Rate**

- **Intended to Protect Recreational Uses from Unacceptable Rate of Gastrointestinal Illness During Swimming**

AQUATIC LIFE CRITERIA

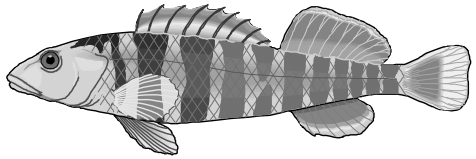
Contain:

- **A Concentration of Exposure**
  - **(how much - magnitude)**
- **A Time Period of Exposure**
  - **(how long - duration)**
- **A Frequency of Exposure**
  - **(how often - frequency)**



AQUATIC LIFE CRITERION EXAMPLE

Freshwater Aquatic Organisms and their Uses Shall not be Affected Unacceptably if the *4-Day Average* Concentration of Chemical X does not Exceed *2.0 µg/L* more than *Once Every 3 Years* on the Average, and if the *1-hour Average* Concentration does not Exceed *4.3 µg/L more than once every three years* on the Average.



FOUR TYPES OF AQUATIC LIFE CRITERIA

Saltwater:
Chronic
(4-Day Average)

Freshwater:
Chronic
(4-Day Average)

Saltwater:
Acute
(1-Hour Average)

Freshwater:
Acute
(1-Hour Average)

SEDIMENT QUALITY ASSESSMENTS

- **Types of Assessments include:**
  - **Sediment chemistry**
  - **Sediment toxicity**
  - **Benthic community**
  - **Bioaccumulation**

Sediment Quality Objectives

- A Standard for Sediment Quality…*that is a means to differentiate sediment impacted by bioavailable toxic pollutants from those that are not*
- Legally no different than a Water Quality Objective
- But…..very difficult to develop
  - There are no state wide sediment quality objectives in the Country
- Applicable to enclosed bays and estuaries only
  - Not applicable to ocean waters
  - Not applicable to inland surface waters

Conceptual Approach

- No single tool can reliably predict whether pollutants in sediment may pose a risk or not
- Applying multiple tools can reliably predict sediment quality
  - *Multiple Lines of Evidence Approach* or *Sediment Quality Triad.*
  - Rarely applied within a regulatory framework. Typically applied using best professional judgment

Phase I Overview

- Direct Effects
  - Narrative SQO: Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California.
  - Receptor: Benthic Communities
  - Exposure: Direct contact
  - Indicators
    - Sediment toxicity, chemistry and benthic community condition
  - Interpretation:
    - Tools and methodology to classify sediments at individual and multiple stations in marine SF bay and SCB bays
    - Interim approach for estuaries and other bays*

Phase I Overview

- Indirect Effects
  - Narrative SQO: Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health
  - Receptor: Human Health risk via consumption of fish and shellfish
  - Exposure: Indirect exposure to contaminants in sediment primarily through the food chain
  - Habitats: Enclosed Bays and Estuaries
  - Interpretation: Non-specific, relies upon existing approaches

Phase I Overview

- Status of Regulatory Provisions
  - Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality was re-adopted September 16, 2008
  - Administrative Record submitted to Office of Administrative Law in November.
  - Final approval required by EPA Region IX
- Phase I SQOs will not become effective until OAL approves the Regulatory Record and EPA approves the standards.

SQOs and Interpretation

LOE CATEGORY COMBINATION	SEDIMENT CHEMISTRY EXPOSURE	BENTHIC COMMUNITY CONDITION	SEDIMENT TOXICITY	STATION ASSESSMENT
1	Minimal	Reference	Nontoxic	Unimpacted
14	Minimal	High	Low	Inconclusive
29	Low	High	Nontoxic	Likely Unimpacted
38	Moderate	Low	Low	Possibly Impacted
58	High	Moderate	Low	Likely Impacted
59	High	Moderate	Moderate	Clearly Impacted

SQOs and Interpretation

Station Assessment categories

- Unimpacted U
- Likely Unimpacted LU

- Possibly Impacted PI
- Likely Impacted LI
- Clearly Impacted CI
- Inconclusive

Phase II Goals

- Direct Effects
  - Develop chemistry, sediment toxicity, and benthic community tools for the Delta to support the narrative SQO protecting benthic communities
  - Develop tools for other water bodies where data is available

- Indirect Effects
  - Develop a standard means to interpret the narrative SQO protecting human health from consumption of shellfish and fish tissue containing contaminants that migrated from sediment up through the food chain.

BIOLOGICAL CRITERIA

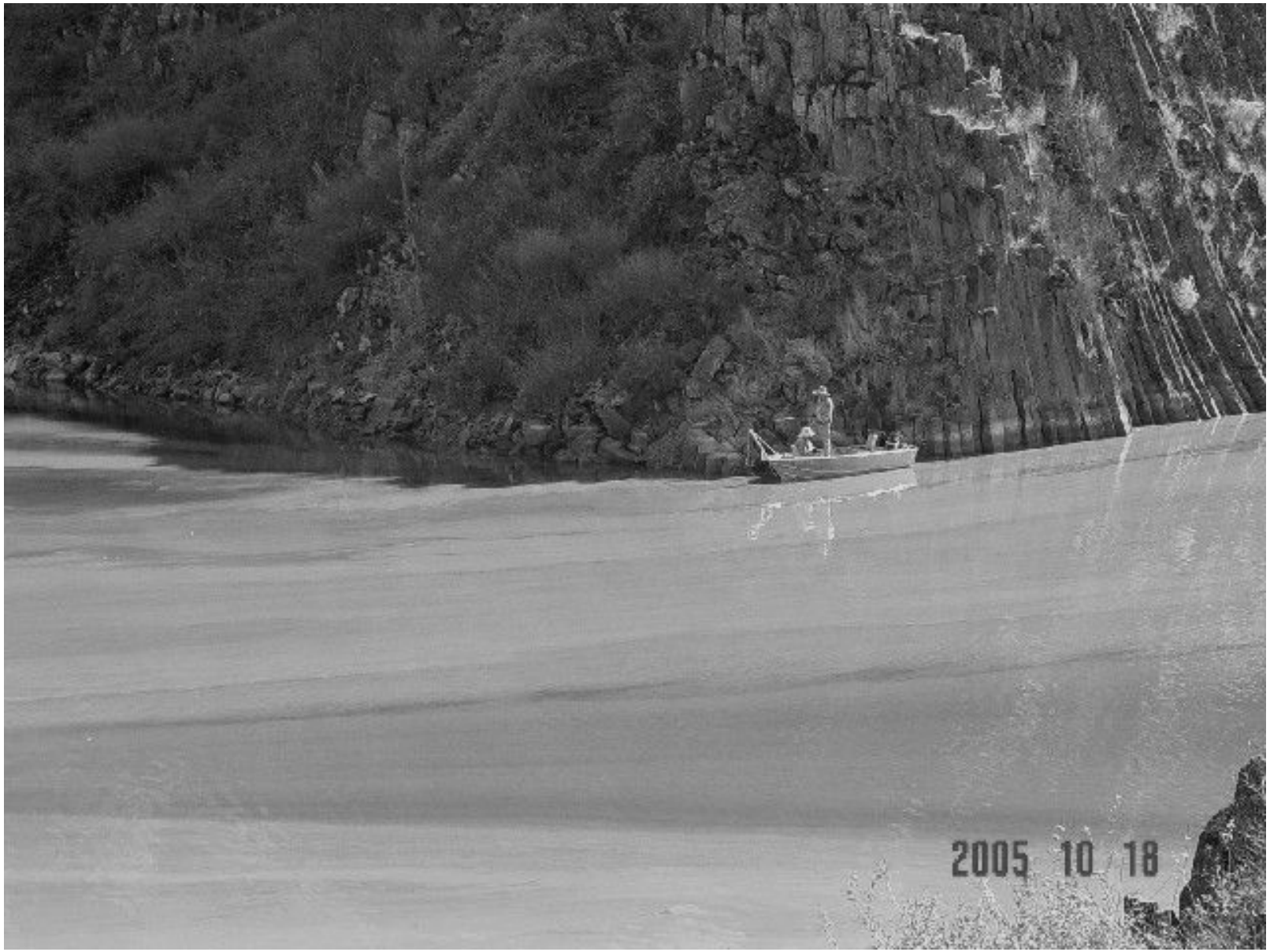
- **Biological Criteria Describe the Desired Biological Condition of Surface Waters for a Specific Aquatic Life Designated Use**
- **Developed Based on an Appropriate Reference Condition**
- **Expressed as Narrative or Numeric**

NUTRIENT CRITERIA

- Expressions of Allowable Levels of Nutrients Related Biological and Chemical Response Variables to Protect Aquatic Life and Recreational Uses

- Developed for Specific Ecoregions /Waterbody Types Based on a Reference Condition or Other Scientifically Defensible Approach
  - e.g., Stressor - Response

Nutrient Criteria



CA Nutrient Numeric Endpoints

- **Regional Technical Advisory Group initiated in 1999 to collaboratively develop nutrient criteria – all Regional Boards participated**
- **Studies undertaken to evaluate alternative options**
- **Existing approach adopted by Regional Boards and other participating agencies -- still under development but basic framework is in place.**

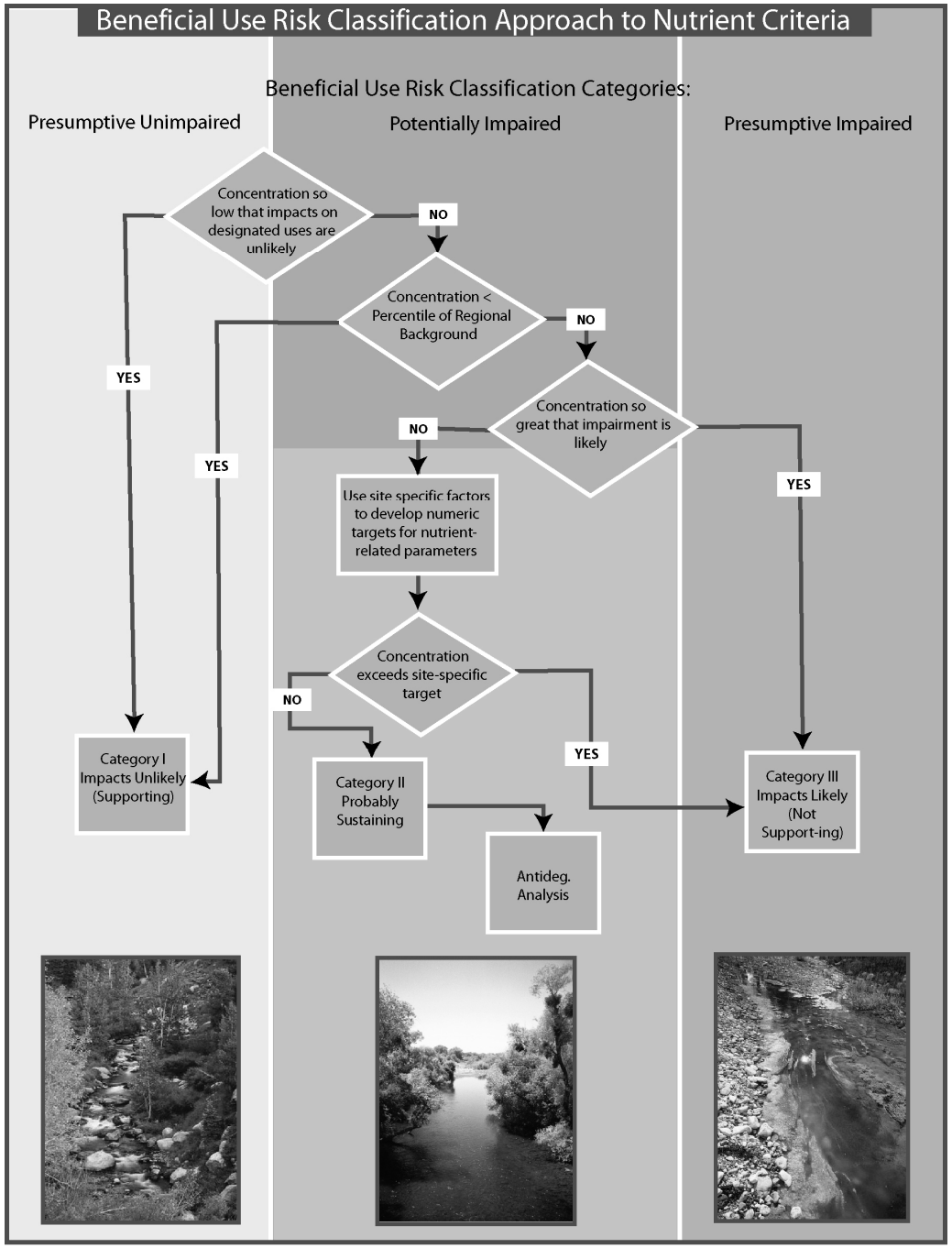
CA Nutrient Numeric Endpoints

Decision framework includes:

- Risk Based Approach: targets for response variables / secondary indicators – benthic algal biomass, DO, pH
- Beneficial Use Risk Categories: **(BURCs)** BURC 1 – Presumptive Unimpaired; BURC 2 – Potentially Impaired; BURC 3 – Presumptive Impaired
- Spreadsheet tools: convert response variable limits (secondary indicator targets) to initial site-specific nutrient concentration goals.

CA Nutrient Numeric Endpoints

- No clear scientific consensus on precise levels so…….
- Category I: Presumptively Unimpaired
- Category II: Potentially Impaired
- Category III: Presumptively Impaired



Example 303(d) Screening BURC Boundaries

	I / II	100	150	C	C	100	100	B
	I / II	5	10	10	10	5	A	B

A = No direct linkage

B= More research needed to quantify linkage

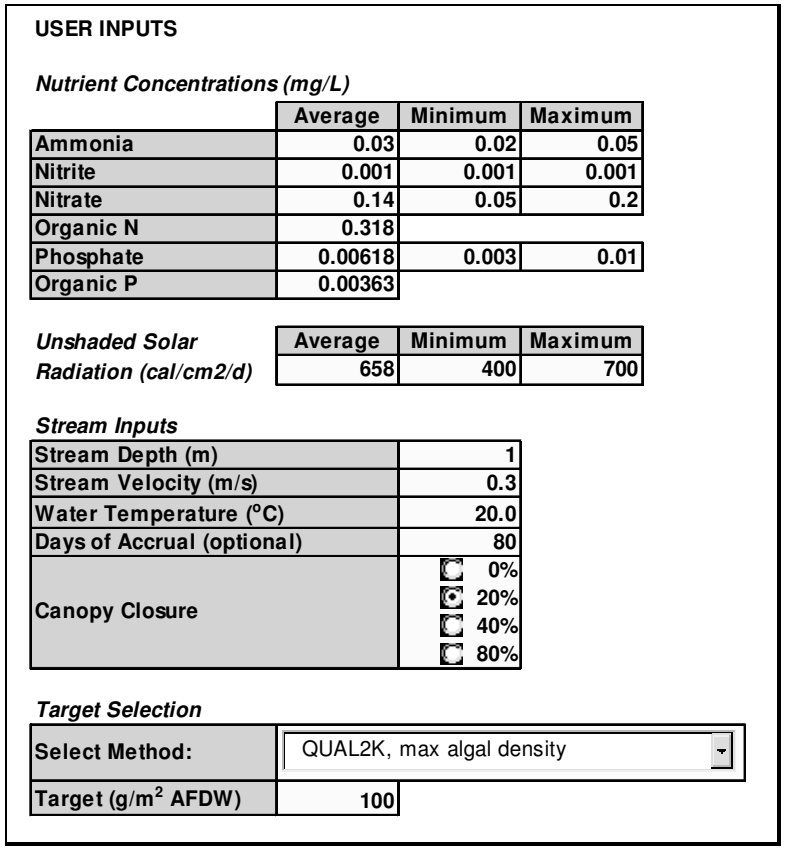
C= Addressed by existing Aquatic Life Criteria

NNE Scoping Tools & Lines of Evidence

- **Spreadsheet tools to convert response variable limits (secondary indicator *targets*) to site-specific nutrient concentration *goals* – used for initial screening – defer to more complete modeling / monitoring studies**
- **Account for exogenous factors**
- **Works for a subset of secondary indicators**
- **Lines of evidence, tools are one component**

Spreadsheet Tools for Estimating Nutrient Concentrations

- **Lakes & Reservoirs: (phytoplankton chl-a) BATHTUB**
- **Streams & Rivers: (benthic algal biomass) various options - QUAL2K, Dodds**



USER INPUTS

Nutrient Concentrations (mg/L)

	Average	Minimum	Maximum
Ammonia	0.03	0.02	0.05
Nitrite	0.001	0.001	0.001
Nitrate	0.14	0.05	0.2
Organic N	0.318		
Phosphate	0.00618	0.003	0.01
Organic P	0.00363		

Unshaded Solar Radiation (cal/cm2/d)	Average	Minimum	Maximum
	658	400	700

Stream Inputs

Stream Depth (m)	1
Stream Velocity (m/s)	0.3
Water Temperature (°C)	20.0
Days of Accrual (optional)	80
Canopy Closure	○ 0% ◉ 20% ○ 40% ○ 80%

Target Selection

Select Method:	QUAL2K, max algal density
Target (g/m^2 AFDW)	100

CA Nutrient Numeric Endpoints
Regulatory Status

- **Estuarine Framework in Development**
- **Possible adoption options:**
  - **Narrative Nutrient Objectives with Nutrient Numeric Endpoint Framework adopted as implementation option.**
  - **Narrative Nutrient Objectives with default Beneficial Use Risk Category Boundaries and NNE Framework as implementation option.**
  - **Other?**

CA Nutrient Numeric Endpoints Next Steps

- **Peer Review of five case studies**
- **Several TMDLs are being developed using the CA NNE**
- **Biomonitoring capabilities are being developed to expand lines of evidence**
- **Develop regional ranges for Beneficial Use Risk Categories**
- **Get EPA to check the Yes column!**